Beneficial Use Reconnaissance Program

2004 Annual Work Plan

For Streams

Idaho Department of Environmental Quality

Table of Contents

List of Figures

List of Tables

Abstract

In 1993, the Idaho Division (now Department) of Environmental Quality (DEQ) embarked on a pilot monitoring program, the Beneficial Use Reconnaissance Project (now Beneficial Use Reconnaissance Program [BURP]) aimed at integrating biological monitoring with physical habitat assessment to characterize stream integrity and the quality of Idaho's waters. The program has been implemented Statewide since 1994. DEQ's past monitoring and assessment practices and the U.S. Environmental Protection Agency's (EPA's) rapid bioassessment protocols (RBPs) provided the foundation for BURP monitoring protocols. The purpose of BURP is to assist in determining the existing uses and beneficial use support status of Idaho's water bodies. The purposes of annual BURP work plans are to provide background information about the program and list program objectives for a specific year. A companion to this work plan, the *Beneficial Use Reconnaissance Program Field Manual for Streams)* describes the methods used in BURP. Centralized crew training will be conducted out of the DEQ Grangeville Satellite Office area. Safety will be emphasized during the training. The objectives for BURP in 2004 are to 1) monitor long-term reference trend sites, 2) fill in data gaps with an emphasis on unassessed assessment units) 3) complete the stated pilot projects and 4) initiate probabilistic site selection design. The four pilot projects scheduled for 2004 are 1) a comparison of EPA Environmental Monitoring and Assessment Program (EMAP) protocols to those currently used by BURP, 2) use of a special ruler for determining Wolman Pebble size classes, 3) an invasive aquatic species watch, and 4) water sampling for nutrient concentrations at approximately 140 sites throughout the State.

The Boise, Coeur d'Alene, Idaho Falls, Lewiston, Pocatello, and Twin Falls DEQ Regional Offices will each have a sampling crew for the 2004 season. There will be a DEQ State Crew for 2004 to complete the pilot project comparing EMAP and BURP protocols. The field season will begin July 1 and end in September 2004. Current forecasts are for streamflows near to below average throughout most of the State. Each crew will sample approximately 50 stream sties. Current estimates are that DEQ will monitor approximately 400 BURP stream sites during the 2004 season.

Introduction

Regulatory Framework (Clean Water Act)

The history of the current regulatory framework for clean water programs in the United States began with the Water Pollution Control Act of 1948 (Public Law 80-845) (Water Environment Federation 1987). This was the first comprehensive statement of federal interest in clean water programs. In 1972, the U.S. Congress passed Public Law 92-500, the Federal Water Pollution Control Act, more commonly known as the Clean Water Act (CWA) (Water Environment Federation 1987). The goal of the act was to restore and maintain the chemical, physical, and biological integrity of the nation's waters (Water Environment Federation 1987). An amendment passed in 1977 stated one goal as the protection and management of waters to ensure swimmable and fishable conditions. This goal, along with the 1973 goal to restore and maintain chemical, physical and biological integrity, relates water quality to more than just chemical characteristics. The CWA and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987.

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the nation. DEQ implements the CWA in Idaho while the EPA provides oversight of Idaho's fulfillment of CWA requirements and responsibilities. DEQ is charged (Clean Water Act, CRF, 39:3601) with providing consistent water body monitoring and assessment methods (Grafe et al. 2002). Standardized procedures and DEQ monitoring protocols provide this consistency. The assessment methods used in the State (Grafe et al. 2002) determine if a water body is supporting or not supporting beneficial uses (see Table 1) such as aquatic life. The Idaho *Water Quality Standards and Wastewater Treatment Requirements* are the rules concerning beneficial uses and associated criteria (State of Idaho, Administrative Rules, 58.01.02). The Idaho water quality standards consist of three parts: 1) beneficial uses, 2) numeric and narrative criteria, and 3) anti-degradation. Beneficial uses are described in more detail below.

Table 1. The beneficial use categories of Idaho water as specified in the Idaho water quality standard (State of Idaho, Administrative Rules, 58.01.02)

Beneficial Use Category	Beneficial Uses
Aquatic Life Support	Cold Water Biota, Salmonid Spawning, Seasonal Cold Water Biota, Warm Water Biota, Modified
Contact Recreation	Primary (swimming), Secondary (boating)
Water Supply	Domestic, Agricultural, Industrial
Other	Wildlife Habitat, Aesthetics, Special Resource Waters

History of the Beneficial Use Reconnaissance Program

In 1993, DEQ embarked on a pilot project known as the Beneficial Use Reconnaissance Project (now known as the Beneficial Use Reconnaissance Program) aimed at integrating biological monitoring with physical habitat assessment to characterize stream integrity and the quality of the water (McIntyre 1993). This project was also developed to meet the CWA requirements of monitoring and assessing biology and developing biocriteria. This pilot relied heavily on protocols for monitoring physical habitat and macroinvertebrates developed by Idaho State University and DEQ in the early 1990s. It closely followed the *Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthos Macroinvertebrates and Fish* developed by EPA (Plafkin et al. 1989). Idaho's Surface Water Quality Monitoring is based on watersheds. The watersheds are grouped into hydrologic units, identified by hydrologic unit codes (HUCs) (Figure 1).

This project was an attempt to use the best science and understanding available to characterize water quality based on biological communities and their attributes. Because of the success of the 1993 pilot, DEQ decided to expand the project statewide in 1994 (McIntyre 1994; Steed and Clark 1995). BURP has remained in use statewide since 1994 (Idaho Division of Environmental Quality 1995, Beneficial Use Reconnaissance Project Technical Advisory Committee 1996, 1997, 1998, 1999). BURP is the ambient monitoring strategy for the State of Idaho at this time.

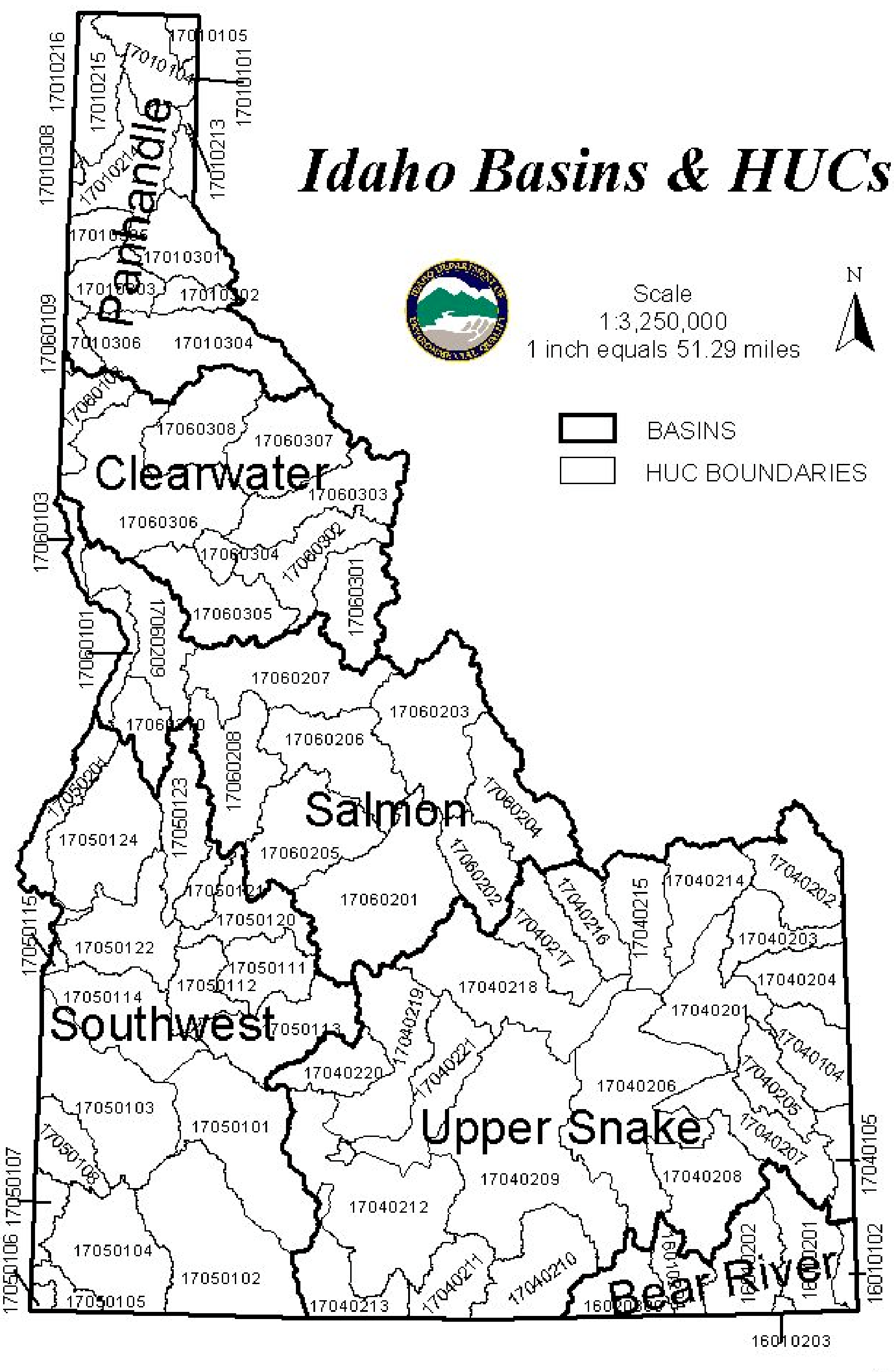
BURP monitoring was greatly reduced for the 2000 field season in order to revise the monitoring and assessment documents and to begin assessment of collected data. A final assessment document was created for the purpose of assessing these data (Grafe et al. 2002). Also in 2000, the *Beneficial Use Reconnaissance Project* was renamed the *Beneficial Use Reconnaissance Program* to emphasize its importance as a permanent DEQ monitoring program. By the end of the 2003 BURP season, a total of 5,182 stream sites had been sampled in Idaho making DEQ a national leader in monitoring for bioassessment.

Overview of Rapid Bioassessment

Barbour et al. (1999) define biological assessment as "an evaluation of the condition of a waterbody using biological surveys and other direct measurements of the resident biota in surface waters." The concept of "rapid bioassessment" resulted from a report by EPA, which suggested a restructuring of monitoring programs at that time (U.S. Environmental Protection Agency 1987). EPA's answer to this suggestion resulted in the first Rapid Bioassessment Protocols (RBPs) being published (Plafkin et al. 1989). RBPs were found to be faster, and thus cheaper, than previous monitoring techniques.

The RBPs have been used nationwide by a wide variety of federal agencies, several states, and other monitoring entities, and have improved over the years (Barbour et al. 1999). Idaho's BURP uses many of the RBP methods and makes modifications to improve consistency and reduce variability, to better fit Idaho's landscape and to meet DEQ's objective (Beneficial Use Reconnaissance Project Technical Advisory Committee 1999). A more detailed review of RBPs can be found in Idaho's 1998 303(d)-list report (Idaho Division of Environmental Quality 1998).

Figure 1: Major Hydrologic Basins and Hydrologic Unit Codes (HUCs) in Idaho



Purposes of the BURP Annual Work Plans

The purposes of BURP's annual work plans are to provide background information about BURP and list yearly objectives. Annual work plans also help improve consistency within the program and serve as a substantial portion of BURP's quality assurance/ quality control (QA/QC) program. The annual work plan gives the monitoring objectives for the year and the priorities for watershed and streams to be sampled. Any pilot projects planned for the year are described as well as any other special considerations that may be unique to a given year. Clark (2001) provided the first work plan for BURP, which did not contain the actual field methods used. The companion to this work plan is the *Beneficial Use Reconnaissance Program Field Manual for Wadeable (Small) Streams* (Beneficial Use Reconnaissance Program Technical Advisory Committee, 2002) which describes in detail the field methods used.

Beneficial Uses of Water in Idaho

The beneficial uses of water in Idaho are defined as "any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics" (Grafe et al. 2002). These beneficial uses are listed in Table 1. Since 1993, the purpose of BURP has been to establish existing uses and help determine the status of these beneficial uses (McIntyre 1993; Idaho Division of Environmental Quality 1995; Beneficial Use Reconnaissance Project Technical Advisory Committee 1996, 1997, 1999).

Beneficial Use Reconnaissance Program (BURP) Support Status

To achieve its purpose, BURP collects and measures key water quality variables that aid DEQ in determining the beneficial use support status of Idaho's water bodies. This determination will tell if a water body is in compliance with water quality standards and criteria and if the water is meeting reference conditions. Reference conditions are those that fully support applicable beneficial uses with little effect from human activity and represent the highest level of support attainable. Reference conditions vary by bioregion. BURP provides the data used in the *Water Body Assessment Guidance* (Grafe et al. 2002). For more details on assessment technique and data handling policies, as well as other policies, see Grafe et al. (2002).

Currently, DEQ recognizes three categories of beneficial use support status: fully supporting, not fully supporting, and not assessed. "Fully supporting' means that the water body is in compliance with water quality standards and criteria, and meeting the reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002). Not fully supporting refers to a water body that is not in compliance with water quality standards or criteria, or not meeting reference conditions for each beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002). The "not assessed" category describes water bodies that have been monitored to some extent, but are missing critical information needed to complete an assessment. Not assessed can also mean that DEQ has not visited the water body and has no information on it.

Annual Work Plan, 2004 Field Season

Objectives:

The monitoring objectives for the 2004 field season are:

1. Monitor long-term reference trend sites,
2. Fill in data gaps with an emphasis on unassessed assessment units,
3. Complete pilot projects listed below,
4. Initiate probabilistic design strategy.

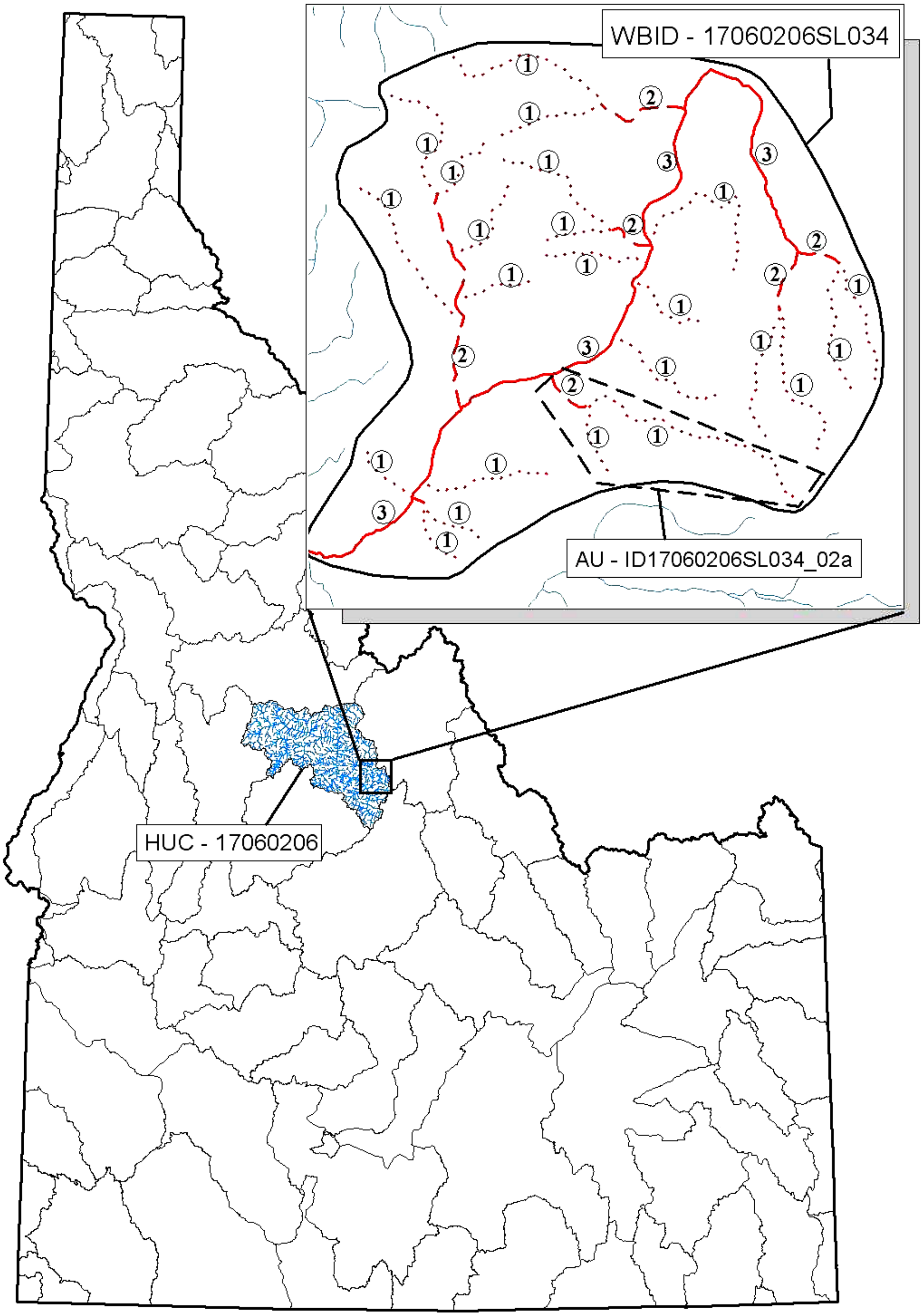
Several authors (Bahls et al. 1992; Grafe et al. 2002: Harrelson et al. 1994; King 1993; McGuire 1992, 1995) have pointed out the need for long-term monitoring data of least-impacted (reference) sites. The purpose of long-term monitoring efforts is to help determine the range of natural variation within a water body (Barbour et al. 1999). For several years, BURP monitoring has placed an emphasis on least-impacted (reference) conditions (McIntyre 1994; Idaho Division of Environmental Quality 1995; Beneficial Use Reconnaissance Project Technical Advisory Committee 1996, 1997, 1998, 1999).

The DEQ monitoring strategy will tie in to the EPA development of a Consolidated Assessment and Listing Methodology (CALM), which has the purpose of improving State monitoring and assessment programs (U.S. Environmental Protection Agency 2001). Six major parts make up CALM: 1) making decisions on attainment/non-attainment of State water quality standards (covering listing/de-listing decisions); 2) designing comprehensive State monitoring networks that support attainment decisions; 3) reporting and presenting data; 4) upgrading elements of State monitoring programs; 5) identifying causes and sources of impairment; and 6) addressing issues such as pathogens, nutrients, sedimentation, and fish advisories. The overall goal of the CALM is to both strengthen and streamline the water quality monitoring, assessment, and listing process for purposes of both sections 305(b) and 303(d) of the Clean Water Act. CALM will provide guidance on the monitoring data and assessment methods needed to support decision making, and on communicating water quality conditions to the public. The benefits of the CALM are, therefore, increased monitoring on all waters, improved decision making on water quality standards attainment and listing of impaired waters, and clearer communication to the public on water quality issues in each State and across the nation (U.S. Environmental Protection Agency 2001). From 1993 through 2003, DEQ attempted to representatively survey all streams within Idaho (the "census approach") and surveyed more than 5,000 sites. These sites represent about 75% of the 2,500 water body identification (WBID) units and 4,700 assessment units (AUs). A WBID usually represents a small watershed and is used in Idaho's water quality standards to geo-locate water in the state. The scale of a WBID is generally comparable to a 6^{th}-field (12-digit hydrologic unit code [HUC]) watershed, although some may be larger or smaller. The AU is a mechanism for grouping waters within a WBID into a meaningful unit for assessment purposes. Presently, most AUs are grouped based on stream order and land use; however, DEQ staff members have the option to further delineate AUs based on additional information. Therefore, the number of WBIDs in Idaho is presently a fixed total, whereas the total number of AUs will continue to change based on current and future assessment decisions. Figure 2 illustrates the scale differences among HUCs, WBIDs and AUs. However, the census approach has proven to be too cost prohibitive to answer the questions posed to the States by the EPA, specifically, “what is the status of the State’s waters?” In 2004 DEQ will shift the monitoring strategy from census surveying to a probability-based random survey that will attempt to answer this specific question posed by the EPA by using properly designed algorithms to develop a reliable estimate of the status of the State’s waters.

DEQ uses stream order to define AUs within WBIDs to characterize comparable water body segments and ensure representative monitoring sites. In essence, AUs allow DEQ to compare streams and interpret site data. Presently, DEQ attempts to representatively monitor all AUs. Any one BURP reach should not represent more than one AU.

The U.S. Environmental Protection Agency has published a guide listing key elements of a State water monitoring and assessment program which serves as a tool to help EPA and the States determine whether a monitoring program meets the prerequisites of CWA Section 106(e)(1).0. They recommend that State programs include the following 10 elements: program strategy, objectives, sampling design, core and supplemental water quality indicators, quality assurance, data management, data analysis and assessment, reporting, evaluation of the program, and general support with infrastructure planning. EPA believes that State-monitoring programs can be upgraded to include all of these elements within the next 10 years. The Clean Water Act (CWA) 1067(e)(1) and 40 CFR Part 35.168(a) require that EPA award Section 106 funds to a State only if the State has provided for, or is carrying out as part of its program, the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor and to compile and analyze data on the quality of navigable waters in the States, and provision for annually updating the data and including it in the Section 305(b) report.

Figure 2. Scale differences among HUCs, WBIDs, and AUs.



Because these elements have not been clearly defined in the past, current State programs show significant variability between States. EPA expects that State water monitoring programs will evolve over the next 10 years so that ultimately all States will have a common foundation of water quality monitoring programs that supports State decision needs. EPA expects that most States will employ an iterative process to fully implement a monitoring program that reflects the elements described in this document, and will work with States to identify annual monitoring milestones. States should develop, over time, a monitoring program addressing the ten elements listed above.

Special Considerations for the 2004 Field Season

The Natural Resources Conservation Service (2001, 2004 supplement) reports the following for streamflow for Idaho for the year 2004, as of April 1, 2004:

> An early winter that looked promising to help southern Idaho from another drought year, is also ending early and will push Idaho into another year of poor water supplies. Currently, snowpacks vary across the State depending upon the melt, and are generally about 80% of average across most of the State, 70% in the Wood and Lost basins and 67% in Bear River. Nearly all of this water year's precipitation fell as snow, resulting in very dry soils under healthy looking snowpacks. Many snow measuring stations recorded their greatest loss or lowest gain of snow water during March. Usually the snowpack continues accumulating in March, while April can be a gaining month or losing month depending upon current weather. However, the combination of warm temperatures and lack of precipitation in March deteriorated this year's snowpack and resulting water supply.
>
> A dry month with above normal temperatures typical of mid-May deteriorated Idaho's snowpack and decreased streamflow forecasts across the state. Snow water equivalent amounts peaked in mid-March, two to three weeks earlier than average. Low elevation snow that lingered in the valleys all winter due to the lack of a mid-winter thaw finally melted. Mid-elevation snow is melting, and higher elevation snowpacks even started melting in March which is very unusual. The worst news may be the lack of accumulation of snow in higher elevations during March. Many mid-elevation snowpacks were average or better and could afford some melt, but high elevation snowpacks were barely average and the lack of snow in March knocked these snow zones to below normal levels. In some basins, snow water equivalent is less than the amounts recorded the past two years. These snow zones are the critical water producing zones to sustain Idaho's streamflow in the later spring and summer months. The premature snow melt and lack of March moisture will be felt later this summer with stream baseflows occurring earlier and below normal after the snowmelt peaks occur.

The current outlook for the 2004 field season indicates that the drought will continue. Field crews throughout the state may travel to sites that are found to have no water. The effect of this on the probabilistic design and the selection of sites will be evaluated at the end of the field season.

Streams and Stream Sample Sites

The Boise, Coeur d'Alene, Idaho Falls, Lewiston, Pocatello, and Twin Falls DEQ Regional Offices will each have a sampling crew for the 2004 field season as will the State Office. Contact information for the DEQ Regional Office BURP Coordinators is given in Figure 3.

Statewide, approximately 400 sites will be monitored. The BURP sites will include 21 samples collected from reference sites (Figure 4). The core reference stations are sampled on a regular basis to help establish a range of conditions and trends. Crews will typically sample lowland and rangeland areas earlier in the season and work upwards (increase elevation) toward forested streams to avoid problems encountered with early season runoff (snowmelt). The plan is to sample each stream at what are summer low flow conditions. A short narrative of what each DEQ Regional Office plans for the 2004 field season is given below. Table 2 contains a summary list of projected BURP sites and samples for the 2004 field season. Figure 3 also shows the approximate area of field operations for each office and coordinator. The field season will begin July 1 and end in September.

- Boise Regional Office – The Boise Regional Office will be sampling throughout southwest Idaho this summer, with particular attention to the Boise-Mores, South Fork Salmon, and Weiser sub-basins. The main objective is to reduce the number of unmonitored perennial streams. Approximately seventy sites are planned, with fish data to be obtained for each, either through data sharing or by electrofishing.

  Nine of these sites were randomly chosen through the EPA's probabilistic design, with one site being sampled twice to account for intra-year variability. Additionally, eight sites from the reference/trend network will be monitored.

- Coeur d'Alene Regional Office – The Coeur d'Alene Regional office will focus on collecting data from the unassessed streams within the region. An estimated 60 sites will be sampled this field season including the monitoring of four reference (trend) sites. Nine of the 60 sites will be from the randomized design outlined in the 2004 Ambient Monitoring Plan for Idaho. The region plans to collect about 50 bacteria samples and there are no current plans to sample any additional sites for fish only.

- Idaho Falls Regional Office – The focus of the Idaho Falls Regional office for 2004 will be on unassessed streams, randomly selected sites, reference/trend sites, and sites requested by the TMDL program. An estimated 110 sites will be monitored with each site being electrofished and having bacteria samples taken. For TMDL purposes the region's efforts will focus on the Upper Henry's Fork and Lemhi River drainages.

- Lewiston regional Office (including the Grangeville Satellite Office) – The Lewiston Regional Office estimates monitoring 42 sites in 2004. These sites will be in the Lower Salmon River tributaries, the North Fork of the Clearwater River drainage, Clearwater River tributaries, and Jim Ford Creek. Nine randomly selected sites will also be monitored according to the Ambient Monitoring Plan as well as three reference/trend sites.

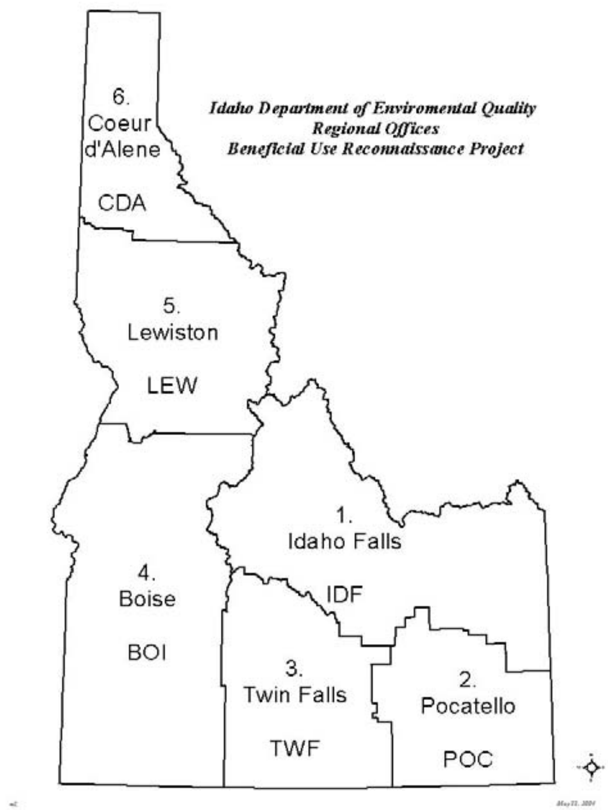
- Pocatello Regional Office –The Pocatello Regional Office plans to sample approximately 40 to 50 sites depending upon the electrofishing needs. Nine of these sites will be from the randomly selected sites outlined in the Ambient Monitoring Plan, while those remaining are targeted sites focusing on streams that have not been sampled since 1999.

- Twin Falls Regional Office –The 2004 work plan for the Twin Falls Regional Office includes nine randomly selected sites spread throughout the region. The region will also be monitoring selected sites in HUCs 17040213, 17040212, 17040211, 17050113 and 17040219. All sites will be electrofished and sampled for bacteria. The regional office is planning on monitoring approximately 45 sites in 2004. If time permits fish samples will be collected on select 2003 sites.

  The Twin Falls Regional Office is also placing thermographs in select areas of the region. The focus of this placement will be on HUC 17040213 in support of the Salmon Falls sub-basin assessment and total maximum daily load programs. Additionally, thermographs will be placed on streams in HUCs 17040212 and 17040219. The thermographs placement will begin as soon as weather permits, expected in late March or early April, and should be complete by mid-May.

- State Office – The State Office will be running a crew this year focusing on a comparison study of the BURP protocols to federal EPA protocols used in the Environmental Monitoring and Assessment Project (EMAP) study. The State crew will be monitoring approximately 21 reference sites and 1 repeat site (on the Pahsimeroi River) throughout the State of Idaho with a high emphasis being placed on those reference sites that fall in ecoregions 12, 16 and 80 (Snake River Basin, Northern Rockies, and the Northern Basin and Range).

Figure 3: Beneficial Use Reconnaissance Program Contacts for 2004 and Areas of Responsibility



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- BURP Program Contact
- BURP State Work Plan
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Table 2. Estimated watersheds to be monitored during the 2004 Beneficial Use Reconnaissance Program (BURP) field season.

Regional Office	Watersheds	Total # Sites	Estimated # Bacteria Samples
Boise	Weiser	**11**	**11**
	Boise-Mores	**12**	**12**
	South Fork Salmon	**11**	**11**
	Upper Owyhee	**11**	**11**
	N & MF Boise	**6**	**6**
	Little Salmon	**4**	**4**
	Probabilistic Sites	**9**	**9**
	Reference/Trend Sites	**8**	**8**
	Total	**72**	**72**
Coeur d'Alene	Coeur d'Alene Lake	**12**	
	Lower Clark Fork	**1**	
	Pend Oreille Lake	**7**	
	Priest River	**7**	
	South Fork Coeur d'Alene	**3**	
	St. Joe River	**10**	
	Upper Coeur d'Alene River	**10**	
	Upper Spokane River	**9**	
	Probabilistic Sites	**9**	
	Total	**68**	**Estimate 50 throughout watersheds**
Idaho Falls	Upper Henry's Fork	**50**	**30**
	Lemhi River	**50**	**35**
	Probabilistic Sites	**9**	**20**
	Total	**109**	**85**
Lewiston	Lower Salmon River	**15**	
	N. Fork Clearwater River	**4**	
	Lochsa River	**4**	
	Clearwater River	**4**	
	Jim Ford Creek	**6**	
	Probabilistic Sites	**9**	
	Reference/Trend Sites	**3**	**Estimate 35 throughout**
	Total	**42**	**watersheds**
Pocatello	(9 Probabilistic Sites included in estimated total)		**20-30**
	Total	**40 - 50**	**20 - 30**
Twin Falls	Reference Sites	**5**	**5**
	Salmon Falls Creek	**4**	**4**
	Big Wood River	**8**	**8**
	South Fork Boise River	**6**	**6**
	Bruneau River	**8**	**8**
	Upper Snake River-Rock Creek	**3**	**3**
	Probabilistic Sites	**9**	**9**
	Total	**43**	**43**
State Office	Trapper Creek	**1**	
	Moose Creek	**1**	
	Webber Creek	**1**	
	East Fork Jarbidge River	**1**	
	Little Jack's Creek	**1**	
	Lime Creek (Trib. to Big Lost River)	**1**	
	St. Joe River	**1**	
	Foehl Cr. (Trib. to N. Fk. Clearwater)	**1**	
	Deep Creek (Trib. to Snake River-Hell's Canyon)	**1**	**None planned at this**
		1	**time**

	Pahsimeroi River and Tributaries Middle Fork Salmon River Tributaries Payette River Tributaries Upper Snake River Tributaries Portneuf River Tributaries **Total**	**2** **2** **2** **3** **3** **22**	
Totals for State		**396-406**	**305-315**

Pilot Projects

A pilot project is a way to try new methods and other ideas out on a trial basis and thus save resources until it is shown that the method should be integrated into BURP. The DEQ BURP Technical Advisory Committee is planning on conducting four pilot projects for the 2004 BURP field season. Most pilot projects will be done out of each regional office on a statewide basis. The pilot projects scheduled for 2004 are described below.

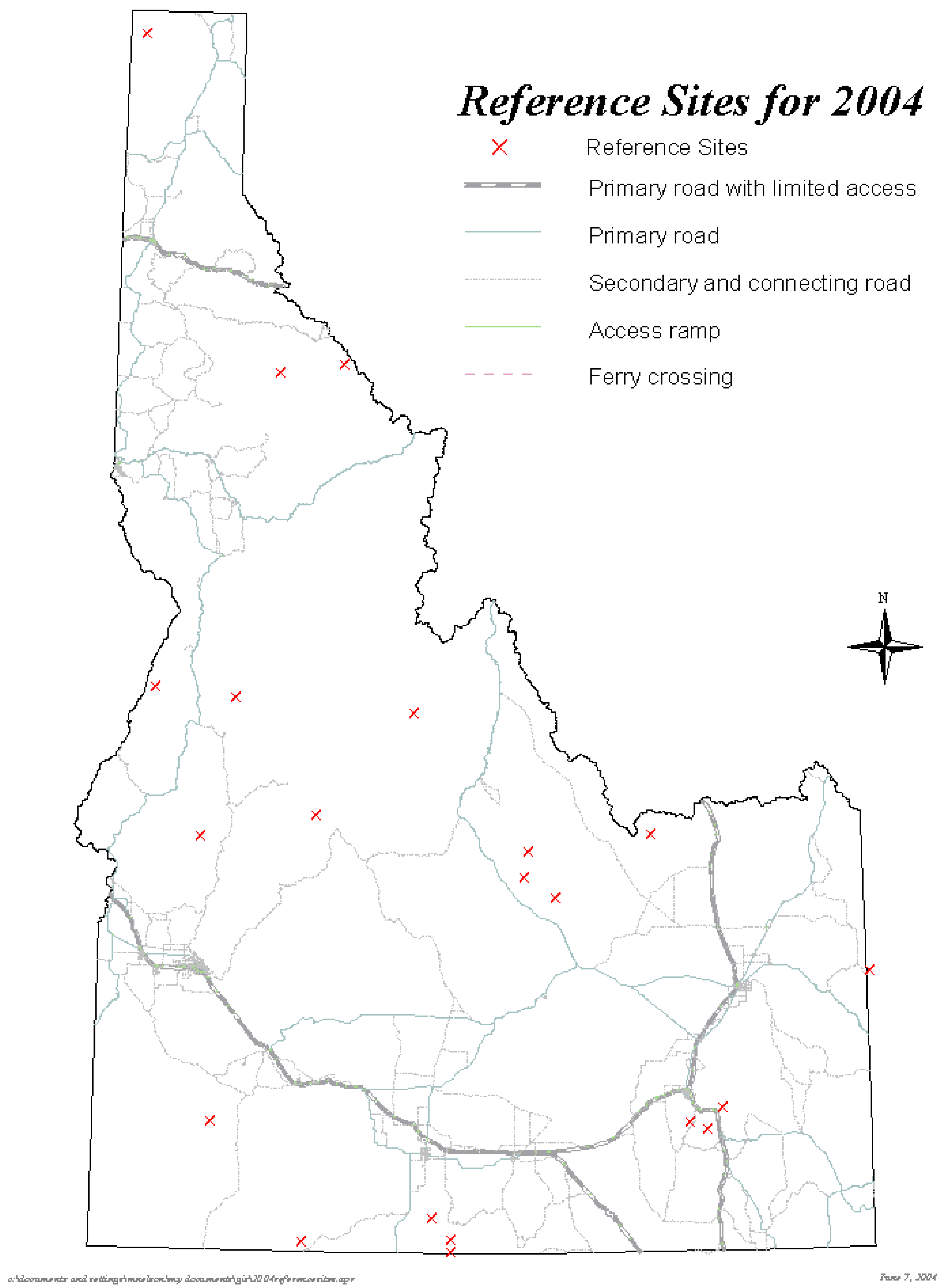
1 – EMAP comparison.
This year a seventh crew will be employed and based out of the State Office in Boise. The purpose of this seventh crew is to gather data on the same reference sites being visited by the EPA-funded EMAP crew for comparison of the two programs. The proposed sites for this comparison are shown in Figure 4.

2 – "Wolman"-ator.
A specially laminated measuring stick with the Wolman Pebble Count size classes delineated along the edge will be incorporated for use during Wolman Pebble Counts. This device was is expected to make pebble counts less tedious and more efficient.

3 – Invasive Aquatic Species.
As per the request of the Governor's office and the DEQ director , the BURP crews will be on the lookout for invasive species. An addition to the regional fish field keys shows the top 10 invasive species of concern throughout the State. If the crews encounter one (or more) of these species, they are to get a latitude and longitude of the site and send a sample back to the State Office, in care of Mark Shumar. The sample can be sent in a Ziploc® plastic bag with the appropriate information marked on the bag (latitude, longitude, and suspected species).

4 – Nutrient monitoring.
As an initial effort to evaluate the prospect of incorporating nutrient monitoring into the BURP efforts, water chemistry samples will be taken at each randomly selected monitoring site in each region. This will give a rough estimate of the current status of nutrients throughout the State. Along with the randomly selected sites, each region is given a number of hand-selected sites for taking water chemistry samples as well. These hand-selected sites are to be done at the regional coordinator's discretion. (See Appendix A for the nutrient monitoring proposal, and Appendix B for water sampling protocols.)

Figure 4. Reference Sites for Comparison of EMAP and BURP Protocols



Program Innovations/Improvements

1. TELEforms.
   The Cardiff™ TELEform® system will be used for all BURP field forms. This is the second year with the TELEforms being in use. These forms allow for quick, easy, and accurate capture of data and subsequent conversion into digital format. The use of the TELEform® system has proven effective in reducing errors. This is an improvement in our QA/QC.

2. Centralized Training.
   This is the third year for the centralized training program. This year the program was presented to the regional administrators as well as senior water quality staff and shown to be a top-level program that improved consistency and quality of the data gathered across the State for BURP. Centralized training is likely the most significant improvement in BURP QA/QC in recent years. In 2002 and 2003, field audits of the crews were very favorable and reflect the success of the centralized training.

3. Regionalized Field Keys
   As an aid in fish field identification, Don Zaroban developed a set of field keys for the BURP crews to use in 2003. These field keys were popular with the crews and the coordinators and will be used again in 2004. A general key was developed to help in the identification of commonly encountered fish families in Idaho. Then separate keys were done to cover the major parts of Idaho: Snake River drainages below Shoshone Falls, Snake River drainages above Shoshone Falls, and the panhandle. An addition for the 2004 field season is the invasive species identification pages added by Mark Shumar. These list the top 10 invasive species (both aquatic plant and animal) that pose a major threat to the State. The crews will be on watch for evidence of these species and should any be encountered, the crew must make a note of the location and send a sample to Mark Shumar.

4. Improved sample-tracking system.
   This is the second season for the BURPTrak system that was implemented last year to facilitate the tracking of samples and field forms. BURPTrak was used to varying degrees last year. After consultation with the regional coordinators, a manual is being developed to help answer questions regarding the system. This year will also see an improved version of the system that allows for the creation and printing of reports that show where all samples and paperwork associated with a given site are located. This will greatly increase the efficiency of the sample processing at the various laboratories.

5 - Ambient Monitoring Plan

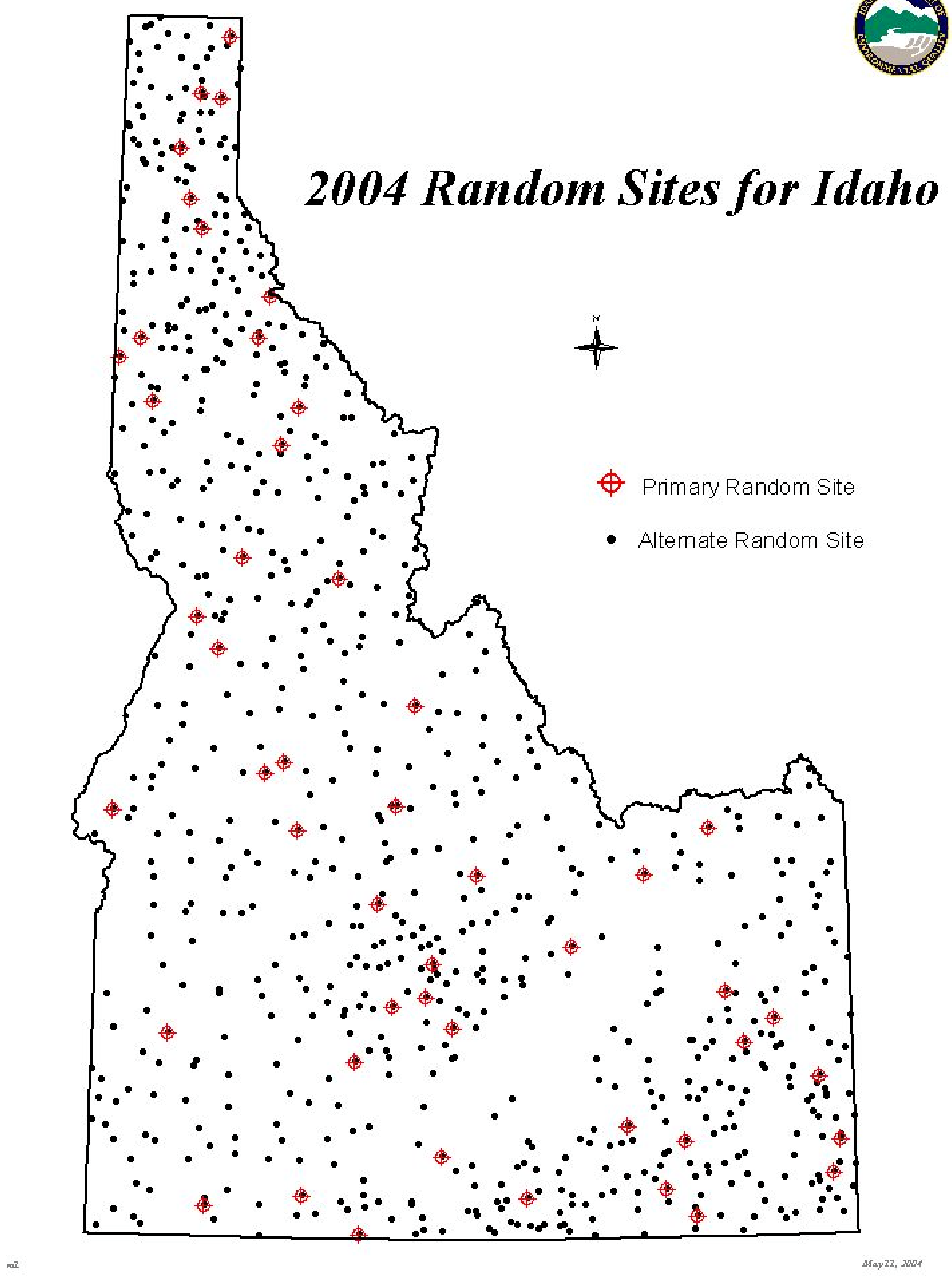
DEQ is drafting a Statewide monitoring strategy to incorporate targeted, census, and probabilistic sampling as a means to describe water quality conditions in Idaho. This strategy considers resources available to implement a comprehensive, long-term monitoring strategy. This strategy is being implemented in the 2004 field season by monitoring 50 randomly selected sites throughout the State. The EPA generated two lists for use in the 2004 field season. The first list gave the site locations for the primary randomly selected sites. This list was distributed to each region and each site evaluated to determine whether it was a viable monitoring site. If the site was not a viable site (as per site selection criteria determined by the Technical Advisory Committee and outlined in Beneficial Use Reconnaissance Program field manual for wadeable (small) streams 2002) then a site was selected from the second list of alternate randomly selected sites. For each site that was deemed not viable for monitoring, a BURP site ID was generated and the reasons why the site was not visited or sampled were documented. Figure 5 indicates those sites that were listed on the primary site list as well as those on the alternate site list.

Other Monitoring Projects

The EPA is conducting a study in the western United States (EPA Regions 8, 9 and 10) that will advance the science of ecological monitoring and demonstrate techniques for regional-scale assessment of the condition of ecological systems. The objectives of this project, called Environmental Monitoring and Assessment Program (EMAP), the Western Pilot Study, are to "develop the monitoring tools (biological indicators, stream survey design, estimates of reference condition) necessary to produce unbiased estimates of the ecological condition of surface waters across a large geographic area (or areas) of the west; and demonstrate those tools in a large-scale assessment" (EPA, 2001). Unbiased estimates require either a complete census of the ecological resources through remote sensing or a rigorous probability survey design that allows extrapolation of results from the sample to the entire resource of interest. Both strategies are used in the EMAP Western Pilot Study: a census for land cover/land use and probability survey for other resources. The study will use a random or stratified random sampling scheme and a rich suite of indicators that include both biota and morphological aspects. See Tonning (1999) for a good overview of the Western Pilot Study. Hughes et al. (2000) provides a current overview of the survey in the United States.

Peck et al. (2001) provides a detailed field manual for the EMAP Western Pilot Study. The manual describes guidelines and standardized procedures for evaluating the biological integrity of surface waters. The document contains the EMAP surface water field operations and bioassessment methods for evaluating the health and biological integrity of wadeable freshwater streams in the Western Pilot Study area.

Figure 5: Random Sites Generated for the State of Idaho



Each western State participating in the study will sample approximately 50 sites over a four-year period. Idaho has sampled about 15 sites per year since 2001 under this program. Although 2003 was predicted to be the last year of sampling for this program, evaluation of results from reference sites initially sampled has led to the concern that reference conditions have not been adequately represented. The 2004 field season will then be comprised of sampling 15 to 20 reference sites to fill in these data gaps. Mary Anne Nelson is the DEQ program contact and Mark Shumar is in charge of field monitoring for EMAP.

In addition, this will be the third year of a four-year project called Regional Environmental Monitoring and Assessment Program (REMAP) (Peck et al. 2002), which will deal with larger water bodies in Idaho. Robert Steed will be in charge of the field monitoring for REMAP. The sampling will take place by raft during August and September. Approximately 20 sites will be sampled throughout the central basin bioregion of Idaho.

Quality Assurance/Quality Control

The Quality Assurance program for BURP is critical to its success and has a direct relationship on the utility, reproducibility, and defensibility of the data obtained by DEQ's monitoring efforts. Quality control is included in every aspect of BURP, including:

- Preparing monitoring documents
- Educating and training BURP coordinators and crews (Beneficial Use Reconnaissance Program Technical Advisory Committee, 2002)
- Electrofishing training
- Crew training, which is now centralized for consistency
- Preparing, calibrating, and maintaining field equipment
- Taking samples
- Conducting independent field audits, writing subsequent reports, and following up on issues raised in the audits
- Identifying biological (macroinvertebrate, fish, algae, amphibian) specimens;
- Housing voucher specimens in a museum collection; checking individual field sheets
- Entering, analyzing, and managing data
- Writing reports and all other aspects of using the data.

Safety Considerations

DEQ considers crew safety the priority for all BURP monitoring. Major safety aspects of the monitoring are discussed in the *BURP Field Manual for Streams*. Some of the safety precautions are listed below.

- DEQ requires that all staff and crew members dealing with BURP have current certifications in first aid and CPR or receive training in both.
- During April 2004, a representative of Smith-Root, Inc® will train and certify personnel in electrofishing use and safety. Electrofishing safety documents are provided to each crewmember (Smith-Root, Inc. 1998).
- DEQ requires that vehicles be stocked with emergency items, including a first aid kit, fire extinguisher, and other safety items.
- Safety issues concerning working around water and using sampling equipment are discussed in the BURP Field Manual, the BURP Training Manual (Beneficial Use Reconnaissance Program Technical Advisory Committee 2004), and in training classes.
- Each BURP crew is responsible for their own safety. DEQ will provide the tools and training necessary for crews to conduct their fieldwork in a safe manner.
- The crews will also take appropriate measures to decontaminate waders, equipment, and vehicles so as not to transfer/introduce weed seeds, aquatic diseases, or other aquatic organisms from one water or watershed to another.

In addition to the items above, each regional office covers topics that are specific to the region.

Acknowledgements

The BURP Coordinators (Dave Hull, Hawk Stone, Glen Pettit, Steve Robinson, Daniel Stewart, and Sean Woodhead) were helpful in supplying the required information concerning their 2004 planned activities and offered other assistance, including technical review, with the completion of this work plan.

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Table 3. List of Acronyms and Abbreviations

AU	Assessment Unit
BOI	Boise Regional Office
BURP	Beneficial Use Reconnaissance Program
CALM	Consolidated Assessment and Listing Methodology
CDA	Coeur d'Alene
CFR	Code of Federal Register
CWA	Clean Water Act (federal)
DEQ	Department of Environmental Quality, State of Idaho
EMAP	Environmental Monitoring and Assessment Program
EPA	Environmental Protection Agency
HUC	Hydrologic Unit Codes
IDF	Idaho Falls Regional Office
LEW	Lewiston Regional Office
POC	Pocatello Regional Office
QA/QC	Quality Assurance/Quality Control
REMAP	Regional Environmental Monitoring and Assessment Program
RBP	Rapid Bioassessment Protocols
SWIM	Surface Water Monitoring Strategy
TAC	Technical Advisory Committee
TWF	Twin Falls Regional Office
WBAG	Waterbody Assessment Guidance
WBID	Waterbody Identification Number

Appendix A

Nutrient Monitoring Proposal

Idaho has invested heavily in biomonitoring wadeable streams over the past 11 years. The Beneficial Use Reconnaissance Program (BURP) has been a very successful State run monitoring program responsible for the collection of biological and habitat information from over 5000 sites throughout the State. BURP was established to determine beneficial use support status. Recent EPA directives, to develop numeric nutrient criteria, have led DEQ to consider adding the collection of traditional nutrient chemistry components such as total phosphorus and total nitrogen to the current protocols.

Analysis of nutrient levels is an important and vital aspect of monitoring water quality. Increased levels of nutrients can have severe effects throughout the aquatic community of a water body. Nutrients such as nitrogen and phosphorus as well as related parameters such as chlorophyll *a* will be examined to compare a single point-in-time water chemistry sample with the biological assessment of several sites throughout the State. Other parameters of interest include specific conductivity, temperature, pH and turbidity.

In supporting EPA directives, DEQ is asking for financial assistance to fund a pilot project within the BURP framework. Questions we hope to answer are:

1) **What is the range of nutrient concentrations in Idaho wadeable streams,**
2) **Is the addition of nutrient monitoring to current protocols feasible and does it give an accurate reflection of the status of the waterbody, and**
3) **What is the correlation between nutrient levels and periphyton assemblages in the waterbody at the time of sampling.**

In an effort to begin the process of developing nutrient criteria, Idaho DEQ is requesting a grant to collect additional nutrient information during the 2004 field season and to evaluate the results in 2005. This proposal outlines a strategy for monitoring nutrient levels and periphyton assemblages at approximately 140 sites throughout Idaho. Considerations such as sample handling, analytical procedures, quality assurance, and data management will also be evaluated as part of this budget proposal.

Aquatic ecosystems respond to the concentrations of certain nutrients to support plant growth and animal life. The overall level of nutrients as well as related algae and plant life is referred to as the trophic state of a water-body. These nutrients are the basic food supply of aquatic organisms such as algae and periphyton, which form the base for higher trophic levels (e.g., macroinvertebrates and fish). Hypereutrophication is a high concentration of nutrients that leads to excess plant growth that will then impact biological communities negatively through interactions with water quality and habitat. Eutrophication associated with anthropogenic sources is termed "cultural eutrophication." Excessive algae and plant growth may lead to depletion of dissolved oxygen levels because of nighttime respiration by living algae as well as the bacterial decomposition of dead algae/plant material (EPA, 2000a). This depletion of dissolved oxygen has an adverse effect on the macroinvertebrate populations and can lead to fish kills. Furthermore, significant increases in plant growth may cause an increase in the pH of the water as plants and algae remove dissolved carbon dioxide during photosynthesis. Hypereutrophication may also change taste and odor characteristics of water thereby increasing the costs of treating it for drinking water (Newton, 1999).

In the EPA's 2000 Report to Congress, the fifth leading cause of impairment in rivers reported by the States in their 2000 lists of impaired waters was excess nutrients. According to this report, roughly 20% of all listed impaired waters were impaired due to excess nutrients (EPA, 2000b). Nutrients of interest include total nitrogen, organic nitrogen and total phosphorus as well as water quality parameters like chlorophyll *a*. These parameters have been identified as the best suited for monitoring changes in water chemistry nutrient levels (EPA, 2000a). Another variable of interest is turbidity, which tends to increase with higher nutrient levels. Turbidity is a measurement quantifying the amount of light scattered as it passes through water due to the concentration of suspended organic (algae) and inorganic (sediment) matter and may be an early indicator of water quality degradation.

In 1993, the Idaho Department of Environmental Quality established a pilot project termed the Beneficial Use Reconnaissance Project (BURP). The purpose of this project was to integrate biological and chemical monitoring with physical habitat structure assessment to characterize the integrity of a stream and the quality of its water (McIntyre 1993). This project was initiated to meet Clean Water Act requirements of monitoring and assessing stream conditions and provide information that would help in developing biocriteria. This pilot project was successfully expanded in 1994 for use throughout the entire State. The protocols developed and used in this program closely follow those outlined in the Rapid Bioassessment Protocols for Use in Streams and Rivers developed by EPA (Plafkin et al. 1989). Since then, data collected under BURP have become the primary measures for assessing stream conditions throughout the State. Assessment of these data is done in accordance with the Water Body Assessment Guidance developed by DEQ and revised in 2002 (Grafe et al. 2002a). The organization of the program consists of a central contact person, regional coordinators, and technical support staff. The program contact person provides overall planning, budget control and oversight while the regional Coordinators prepare and direct each year's field work. Over the past

10 years, BURP has monitored over 5,000 sites and assessed assessment units based on these data.

Current BURP protocols for data collection are based on the needs of WBAG for which several indexes each use a variety of metrics to determine the overall biological condition of the water body being assessed. Three indexes in the WBAG process - a stream macroinvertebrate index (SMI), stream fish index (SFI) and stream habitat index (SHI) - address the assessment of collected stream data. Each of these indexes is made up of a collection of metrics for which field crews gather data on approximately 300 sites every year. Formulation of these metrics and indexes is outlined in the DEQ published document Idaho Small Stream Ecological Assessment Framework (Grafe, 2002b). The focus of the BURP program has been on rapid bioassessment procedures which describe the effect of water quality on the aquatic life communities that are most closely affected by deterioration in water quality. Since biological communities present in a water body tend to track effects of both acute (one time) changes in water chemistry as well as long term (chronic) changes, emphasis on the collection procedures and subsequent assessments has moved away from chemical analysis of streams. The work proposed here is considered for addition to this year's BURP methods on a select number of sites to help determine the possibility of future support for these tests after evaluating financial costs, time spent, and the value of the information. This work will also support the creation of a stream diatom index that will be evaluated for its usefulness in assessing water quality in combination with the other indices mentioned previously.

In 2004 DEQ will shift the ambient monitoring strategy in Idaho away from targeted monitoring to a random site selection which will better answer the question "what is the condition of the State's waters" (Grafe, 2002c). The current monitoring plan calls for a set of 50 randomly selected sites throughout the State to be monitored while the remainder of monitoring resources will be focused on sampling assessment units that have not yet been monitored. This randomly generated site list will give a statistical estimate of the condition of the waters in the State while the targeted sites will identify problem areas among those waters that have not yet been monitored. These 50 sites will be the first priority for nutrient sampling under this proposal with an additional 120 hand-selected sites also being monitored throughout the State.

It is proposed that in addition to the BURP protocols for habitat, macroinvertebrates, and fish, water samples be taken and analyzed in the field for specific conductivity, temperature, and pH and in the lab for total nitrogen, total phosphate, total Kjeldahl nitrogen, turbidity, and chlorophyll *a*. These elements have been selected as a first step in identifying water chemistry conditions around the State.

PROPOSED MONITORING STRATEGY

Sample Handling:
Monitoring for nutrients such as nitrogen and phosphorus is an addition to current BURP methods that can be accomplished with some changes in the current process. Collecting these water samples at every BURP site may not be practical since the crews remain in

the field for up to four days at a time while the samples must be submitted to the laboratory in less than 48 hours. This need to transport the sample from the field immediately and get it to an appropriate laboratory is a major logistical challenge. Using local laboratories, where available, can help solve this problem. Twin Falls, Lewiston, Coeur d'Alene, Pocatello and Boise regional offices each have established working relationships with private local laboratories. The Idaho Falls regional office does not currently have an established local laboratory and sends their water samples to the State laboratory in Boise. While using local laboratories offsets the issue of getting the sample to the lab in 48 hours or less, it also introduces differences in the quality of data generated. This issue will be addressed later when discussing quality assurance and quality control measures.

This proposal evaluates the cost of analyzing water samples for total nitrogen, total phosphorus, total Kjeldahl nitrogen, turbidity, and chlorophyll *a* from the sites outlined in DEQ's Ambient Monitoring Plan (Grafe, 2002c). As described earlier, these parameters have been shown to have an effect on water quality and the associated aquatic community. Monitoring these parameters may help in understanding the consequences of changes in these levels. Sampling procedures for these protocols will follow those listed in the Field Operations Manual for Wadeable Streams (EPA, 2002). Water samples must be collected at a location just upstream from the sampling reach in a flowing portion near the middle of the stream. Briefly, the sample container must be rinsed three times with streamwater, with each rinse being discarded downstream from the sampling point. The sample container is then filled to the top with streamwater and capped. This sample will be used for the TN, TP, TKN and turbidity analysis. A second container (amber glass) is then used for collecting the sample for chlorophyll *a* analysis. When collecting the water sample for chlorophyll *a* analysis, the sample container must be rinsed three times with streamwater and each rinsate must be discarded downstream from the sampling point. The amber glass sample bottle is then held at approximately 1 foot below the water level and filled to the top, taking care not to allow contact between the sampler and water flowing into the container. Both samples must be immediately placed in a cooler filled with ice to cool. The crews must make instantaneous measurements of pH, temperature, and specific conductivity in situ using field grade meters calibrated at least once daily. These measurements must be recorded in a separate field of the BURP field forms.

Once the crew finishes monitoring the site, the water samples will be taken as soon as conditions allow, recognizing the 48-hour holding time limit, to the regional office for overnight shipping to the laboratory. Holding times (from when the sample is taken to when it must be analyzed) is 48 hours for total phosphorus testing. These samples will not be preserved with sulfuric acid for several logistical and safety reasons. Each crew will also be required to do at least two quality control samples for every ten samples collected.

Analytical Methods:

Methods for analysis are taken from standard EPA methods. Determination of nitrate-nitrite nitrogen is by automated colorimetry (EPA Method 353.2) and determination of total Kjeldahl nitrogen (TKN) by EPA Method 351.2. Total phosphorus is by EPA method 365.4 and turbidity by EPA 180.1. Chlorophyll *a* is analyzed using EPA method 445.0. It is also proposed to measure pH, temperature, and specific conductivity. These measurements should be done in the field using field grade meters. It is proposed to use a combination meter that can measure for pH, temperature, and specific conductivity to reduce the amount of equipment that must be packed into each site.

Quality Assurance:
Prior to the field season, verification of data quality from each laboratory will call for a comparison of inter-laboratory variability. Each laboratory to which samples are sent is required as part of EPA certification to perform testing upon a range of standards provided by the National Institute for Standards and Technology (NIST). These results are then reported as part of the laboratory's procedures for certification. Obtaining results from these standardization tests from each laboratory will give an idea of what the variability of results from different laboratories will be. If the results of this inter-laboratory comparison show greater than a 15% variance between the results of these quality control samples, all samples shall be analyzed at the State laboratory in Boise. The resulting increase in personnel, travel and shipping costs will cause a reduction in the number of sites analyzed to approximately 125.

Quality control issues will be addressed in part as described above using field control samples and requesting certification standards from each of the laboratories participating in the analysis of these samples. Each crew will also be required to do at least two quality control samples for every ten samples collected. These quality control samples consist of 1) a sample container transported to the field, rinsed and filled with distilled water and allowed to remain open to the air while the crew finishes all other data collection, and 2) a sample collected simultaneously at the same site. Both control samples are then capped, placed on ice with the other sample and transported to the laboratory for analysis. These control samples are used to estimate sample contamination from the container and atmospheric interference as well as any variation due to sample gathering protocols. If either quality control sample shows a nutrient level greater than 20% higher than the sample for the particular site, the data for that site will be disregarded.

Another quality control item that will be requested from the laboratories is the within-day and day-to-day variability reports for each of the analytical methods used. This will track changes in data precision and between sample runs over the course of the field season. Any samples that were analyzed after exceeding holding times will not be included in the database, nor will samples that have been improperly labeled, handled, shipped, analyzed, or stored.

Data Handling/Analysis:
Results from all analyses will be stored electronically and housed at the Idaho Department of Environmental Quality. This electronic format can be cross-referenced with the current BURP database that houses the data used in calculating the indexes of interest and making water quality assessments. Analysis of these data will result in an overall estimate of nutrient levels throughout the State based upon the randomly selected sites as well as an analysis of targeted site nutrient levels.

A year-end report will be generated to answer the previously stated questions. To answer the first question nutrient levels for each of the sites will be reported within six months of the end of the field season (February 2005). However, since macroinvertebrate and fish identification results will not be complete until spring of 2005, any comparison of these biological indices to the water chemistry can not occur until June of 2005.

To address the second question this report will 1) evaluate the cost per site of additional nutrient analysis to the current BURP protocols, 2) discuss issues discovered when implementing this approach, and 3) make recommendations regarding efficiency and improvement that may be made to data collection.

The last question proposed calls for an evaluation of nutrient levels and periphyton assemblages in the waterbody. This will require the identification and enumeration of the periphyton assemblages present in the water at the time of sampling. This secondary analysis will be supported during the second year with the samples being analyzed during the winter of 2004-2005 and results being reviewed and reported on in 2005, corresponding to the report comparing biological indices of interest to the nutrient levels. Submission of the reports detailed here will fulfill the requirements of this grant.

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Appendix B

Water Chemistry Sampling
Standard Operating Procedure

Water Chemistry Sampling
Standard Operating Procedure

A. Materials Required:

1 – 500 mL clear glass container with lid (or plastic cubitainer)
1 – 1000 mL amber glass container with lid
1 – Cooler large enough to hold above listed containers along with ice
1 – pH/Temperature/specific conductivity meter
ice sufficient to cool samples
Wash bottle with deionized water for rinsing
calibration standards for pH and conductivity
labels
pen
shipping box (if necessary)
dry ice (optional)
distilled water

B. Calibration procedures:

1. pH calibration
   Important information on the pH/Con 10 Waterproof meters: When you calibrate the meter for pH, previous calibration data are replaced on a point by point basis. For example, if the meter was previously calibrated at pH 4.0, 7.0, and 10.0, and you calibrate again at pH 7.0, the meter retains the data at pH 4.0 and 10.0.

   a. Press the MODE key to select pH mode. The pH indicator appears in the upper right hand corner of the display.
   b. Rinse the probe thoroughly with de-ionized water or a rinse solution. Do not wipe the probe; this causes a build-up of electrostatic charge on the glass surface.
   c. Dip the probe into the calibration buffer. The end of the probe must be completely immersed into the sample. Stir the probe gently to create a homogeneous sample.
   d. Wait for the measured pH value to stabilize. The READY indicator will display when the reading stabilizes.
   e. Press CAL/MEAS to enter pH calibration mode. The primary display will show the measured reading while the smaller secondary display will indicate the pH standard buffer solution. NOTE: if using a pH buffer other than pH 7.0 press the up or down arrow to scroll up or down until the secondary display value is the same as your pH buffer value (pH 4.00, 7.00, or 10.00).
   f. Wait for the measured pH value to stabilize. The READY indicator will display when the reading stabilizes.
   g. After the READY indicator turns on, press ENTER to confirm calibration. A confirming indicator (CON) flashes and disappears. The meter is now calibrated at the buffer indicated in the secondary display.
   h. If you are performing multipoint calibrations, go to the next step. If you are performing a single point calibration, go to (l).

   i. Press the up or down arrow keys to select the next buffer value you want to calibrate (pH 4.00, 7.00 or 10.00).
   j. Rinse the probe with de-ionized water or a rinse solution, and place in the next pH buffer.
   k. Follow steps e-j for additional calibration points (up to 3 values).
   l. When calibration is complete, press CAL/MEAS to return to pH measurement mode.

2. Conductivity Calibration
   a. You can calibrate at one point per range of the meter (a total of up to four calibration points). However, only the ranges that have been calibrated have maximum ± 1% full-scale conductivity accuracy. If a range was not calibrated, the meter automatically detects the closest range calibrated and uses that calibration information.
   b. Pour out two separate portions of the desired calibration standard and one of de-ionized water into separate clean containers.
   c. Press the MODE key to select conductivity Mode. The μS or mS indicator will appear on the right side of the display.
   d. Rinse your probe with de-ionized water, then rinse the probe in one of the portions of calibration standard.
   e. Immerse the probe into the second portion of calibration standard. The meter's autoranging function selects the appropriate conductivity range (four ranges are possible). Be sure to tap the probe to remove air bubbles. Air bubbles will cause errors in calibration.
   f. Wait for the reading to stabilize. The READY indicator lights when the reading is stable.
   g. Press the CAL/MEAS key. The CAL indicator appears above the primary display. The primary display shows the factory default and the secondary display shows the temperature.
   h. Press the up or down arrow keys to scroll to the value of conductivity standard. Press and hold the up or down arrow keys to scroll faster. The meter automatically compensates for temperature differences using a factor of 2% per ^{o}C.
   i. Press the ENTER key to confirm calibration.
   j. Upon confirmation, the CON indicator appears briefly. The meter automatically switches back into Measurement mode. The display now shows the calibrated, temperature compensated conductivity value.
   k. For calibration in other ranges (max: four ranges) repeat steps a through j with the appropriate calibration standards.

C. Measurement Procedures:

1. Immediately upon arrival at site, perform calibration of pH/Temp/Cond meter according to section B above. Record calibration parameters on daily log sheet.
2. After calibration, travel to a point in the stream reach where the current is flowing (riffle, run or glide). Avoid eddies, backwashes and stagnant water.

3. Select Temperature function, allow reading to stabilize and record temperature in comments section of field form
4. Select pH function, allow reading to stabilize and record pH as above
5. Select specific conductivity function, allow reading to stabilize and record as above.
6. Rinse meter electrode/membrane/probe and store properly.
7. Add labels to clear and amber glass bottles. Label with BURP Site ID, date, collector's name, and either Nutrient (sample in clear glass container or cubitainer) or Chlorophyll *a* (sample in amber glass container).
8. Continue with BURP measurements.

~~D. Sampling Procedures:~~

1. After completing all other BURP measurements, remove caps from both bottles.
2. Go to a spot 10 meters upstream from the end of the reach. Rinse clear glass container (or plastic cubitainer) with stream water in the following manner:
    a. Grasp container firmly in the middle. Submerge container with mouth of container facing upstream and slightly elevated with respect to the bottom of the container.
    b. Do not allow water flowing into container to come in contact with the sampler's hands or skin before entering the sample container.
    c. Fill container ½ full, remove from stream.
    d. Replace cap and invert, shaking gently.
    e. Discard rinsate downstream from sampling spot.
    f. Repeat *a* through *e* twice more.
    g. Again, not allowing contact between water flowing into container and sampler, submerge container, keeping top elevated, to a distance of 1 foot below surface level (if stream is less than 1 foot deep, go to a distance halfway between water surface and stream bottom).
    h. Fill container to neck of bottle. Cap and place on ice immediately.
    i. Repeat *a* through *h* for 2nd sample using 1000 mL amber glass container.

3. Water samples must be to the laboratory for testing within 48 hours of sampling. For those samples that must be shipped, package the sample in shipping box with dry ice to maintain cool temperature. Ship overnight to appropriate lab. For those samples that are not shipped, do not deliver samples on Friday as the lab will not likely have enough time to complete sample processing before the holding time expires.